

Figure 1

Accuflo2027 Aging at RT

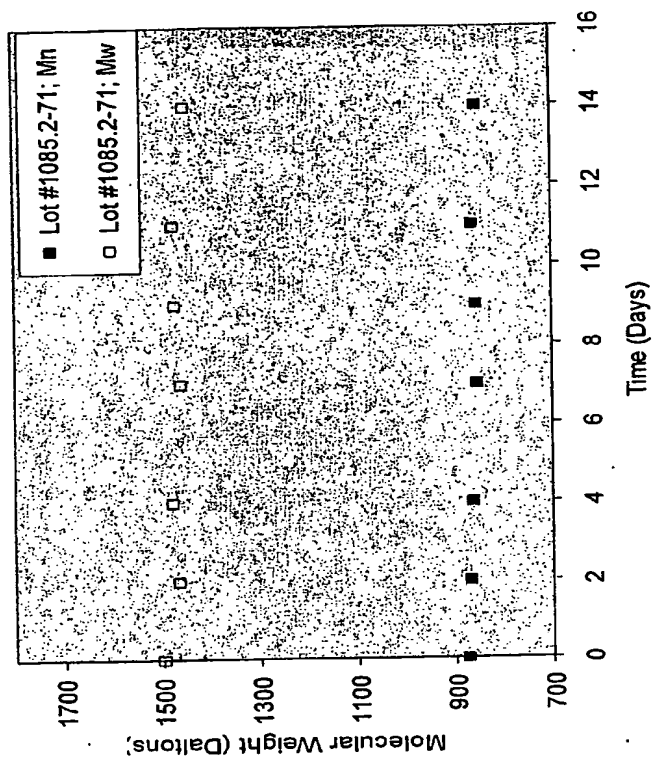


Figure 2

Accuflo2027 aging at 40C

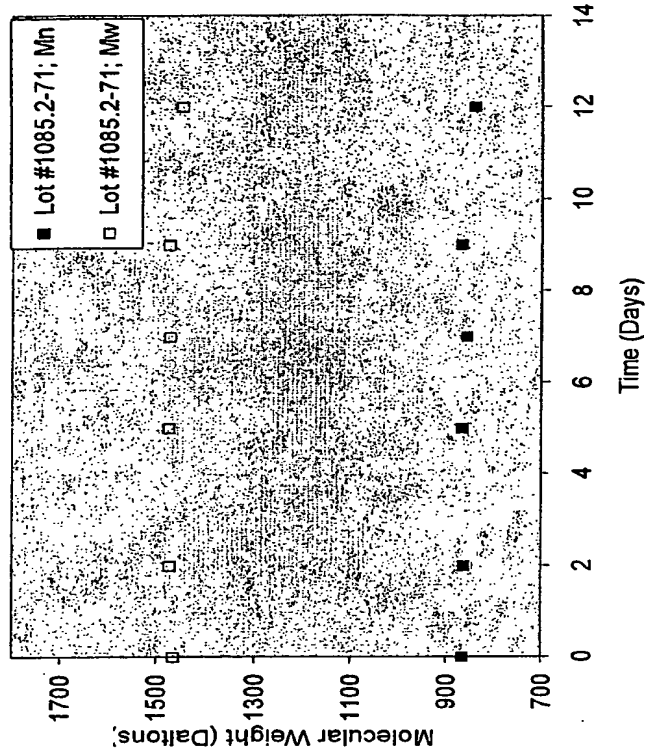


Figure 3

Material	M_n	M_w	M_p	M_z	PDI
Accuflo 2025	870	1523	1256	2416	1.75
Accuflo2027	862	1473	1218	2385	1.71

Table I

Step	Time (s)	Speed (rpm)	Acc (rpm/s)	Dsp	Arm1	Arm2	Exh flow
1	1.0	0	10000		H, NW	H, NW	200
2	0.5	0	10000		H, NW	H, NW	200
3	0.5	0	10000	16	DD, W	H, NW	200
4	0.5	0	10000		DD, NW	H, NW	200
5	0.5	0	10000		DD, NW	H, NW	200
6	0.5	0	10000		DD, NW	H, NW	0
7	0.5	0	10000		center, 150mm/s, NW	H, NW	0
8	1.0	0	10000	2	center, 150mm/s, NW	H, NW	0
9	6.5	1000	10000		H, NW	H, NW	0
10	1.0	1000	10000	15	DD, NW	H, NW	0
11	0.5	0	10000		Dispn 2, 150mm/s W	H, NW	0
12	10.0	2000	10000	1	Dispn 3, 10 mm/s, NW	H, NW	0
13	5.0	800	2000		H, NW	H, NW	0
14	3.0	100	10000		H, NW	H, NW	0
15	5.0	300	10000		H, NW	H, NW	0
16	7.0	600	10000		H, NW	H, NW	0
17	9.0	900	10000		H, NW	H, NW	0
18	11.0	1200	10000		H, NW	H, NW	0
19	3.0	1500	10000		H, NW	H, NW	0
20	15.0	2000	10000		H, NW	H, NW	0
21	15.0	2000	10000		H, NW	H, NW	200
22	3.0	1500	10000	11,12	H, NW	WE, W	200
23	0.5	1500	10000	13	H, NW	WE, 3 mm/s NW	200
24	1.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
25	2.0	1600	10000	13,21	H, NW	WE, 3 mm/s NW	200
26	2.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
27	2.0	2000	10000		H, NW		200
28	1.0	0	10000		H, NW		200

Table 2

Recipe position data (mm)

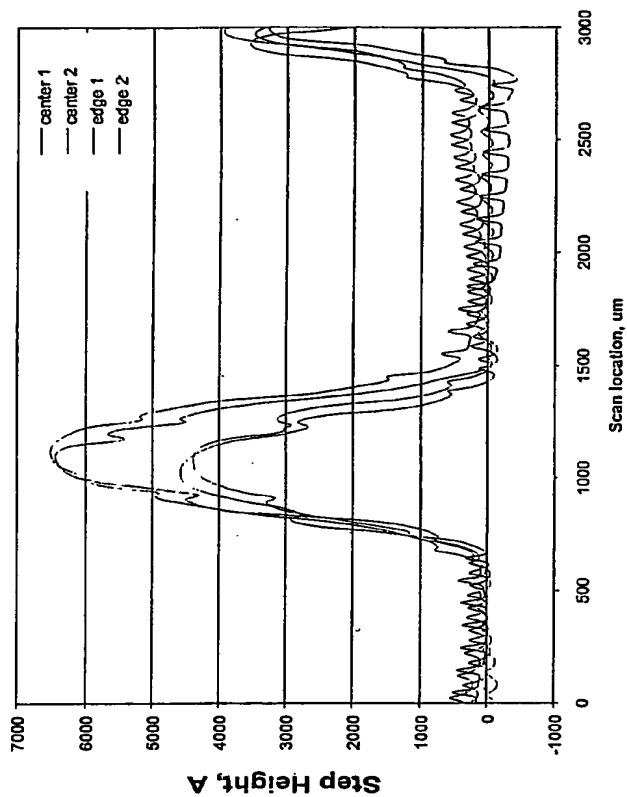
home	-57.91	dummy dispn	0	center	173.71
end	184.01	dispense 2	79.99	edge	79.99
		dispense 3	172.7		

Table 3

Dsp #	Dsp name	Solvent	Flow rate
1	SOD nozzle 1	Accuflo	0.45 ml/s
2	Solvent nozzle 2	PGMEA	0.60 ml/s
11	Inner cup rinse	PGMEA	300
12	Outer cup rinse	PGMEA	300
13	Edge bead rinse	PGMEA	30
15	Nozzle 1 rinse	PGMEA	30
16	Nozzle 2 rinse	PGMEA	30
21	Backside rinse	PGMEA	50

Table 4

Figure 4



Event	Time	RPM	ACC	DSP	Arm1
1	0.5	0	10000		disp 1, 150 mm/s, W
2	0.5	1000	10000	9	disp 1, 150 mm/s, NW
3	3.0	1500	10000		disp 1, 150 mm/s, NW
4	3.0	1500	10000		disp 5, 150 mm/s, NW
5	5.0	1500	10000		disp 5, 150 mm/s, NW
6	0.1	1000	10000	4	disp 5, 150 mm/s, NW
7	14.0	1000	10000		center, 20 mm/s, NW
8	2.0	800	10000		center, 150 mm/s, NW
9	3.0	100	10000		home, 150 mm/s, NW
10	4.0	300	10000		home, 150 mm/s, NW
11	5.0	600	10000		home, 150 mm/s, NW
12	6.0	900	10000		home, 150 mm/s, NW
13	6.0	1200	10000		home, 150 mm/s, NW
14	20.0	2000	9000		home, 150 mm/s, NW
15	1.0	1000	10000		home, 150 mm/s, NW
16	5.0	1500	9500		home, 150 mm/s, NW
17	5.0	1500	9500	13,21	home, 150 mm/s, NW
18	4.0	1500	9500	13,21	home, 150 mm/s, NW
19	10.0	2000	10000	13,21	home, 150 mm/s, NW

Table 5

Pump recipe	
time	14 s
volume	6 ml

Recipe position data (mm)			
begin	89	center2	170.5
end	180	edge	87
center1	170	dispense 5	88
		dispense 1	170.5

Table 6

Dsp #	Dsp name	Solvent	Flow rate
4	SOD nozzle 1	Accuflo rev2	use pump recipe
9	solvent	PGMEA	PGMEA pressure 0.1 Mpa
13	back side rinse	PGMEA	-
21	Edge bead rinse	PGMEA	-

Table 7

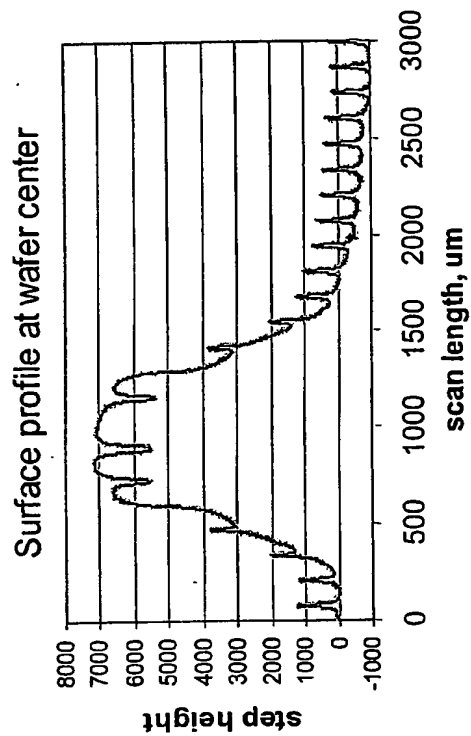
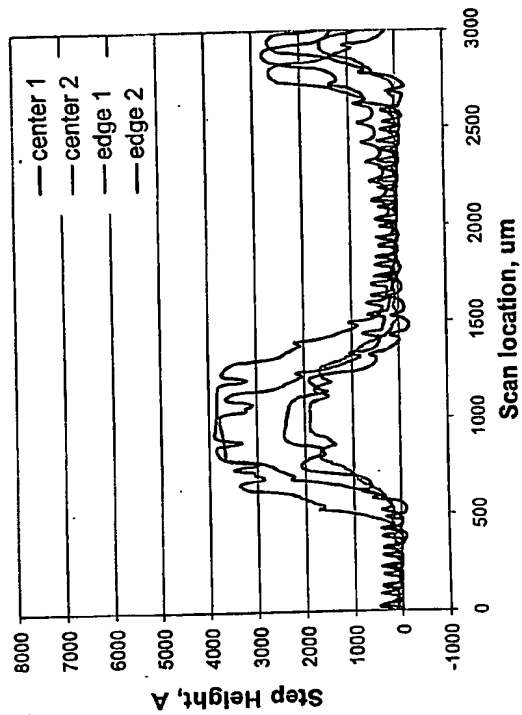


Figure 5

Figure 6



Step	Time (s)	Speed rpm	Acc rpm/s	Dsp	Arm1	Arm2	Exh flow
1	1.0	0	10000		H, NW	H, NW	200
2	0.5	0	10000		H, NW	H, NW	200
3	0.5	0	10000	16	DD, W	H, NW	200
4	0.5	0	10000		DD, NW	H, NW	200
5	0.5	0	10000		DD, NW	H, NW	200
6	0.5	0	10000		DD, NW	H, NW	0
7	0.5	0	10000		center, 150mm/s, NW	H, NW	0
8	0.5	0	10000	2	center, 150mm/s, NW	H, NW	0
9	6.5	1000	10000		H, NW	H, NW	
10	1.0	1000	10000	15	DD, NW	H, NW	
11	0.5	0	10000		Disp 2, 150mm/s W	H, NW	0
12	14.0	2000	10000	1	Disp 3, 10 mm/s, NW	H, NW	0
13	5.0	800	2000		H, NW	H, NW	0
14	3.0	100	10000		H, NW	H, NW	0
15	5.0	300	10000		H, NW	H, NW	0
16	7.0	600	10000		H, NW	H, NW	0
17	7.0	900	10000		H, NW	H, NW	0
18	7.0	1200	10000		H, NW	H, NW	0
19	3.0	1500	10000		H, NW	H, NW	0
20	10.0	2000	10000		H, NW	H, NW	0
21	10.0	2000	10000		H, NW	H, NW	200
22	3.0	1500	10000	11,12	H, NW	WE, W	200
23	0.5	1500	10000	13	H, NW	WE, 3 mm/s NW	200
24	1.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
25	2.0	1500	10000	13,21	H, NW	WE, 3 mm/s NW	200
26	2.0	1500	10000	13	H, NW	WE, 3 mm/s NW	200
27	2.0	2000	10000		H, NW		200
28	1.0	0	10000		H, NW		200

Table 8

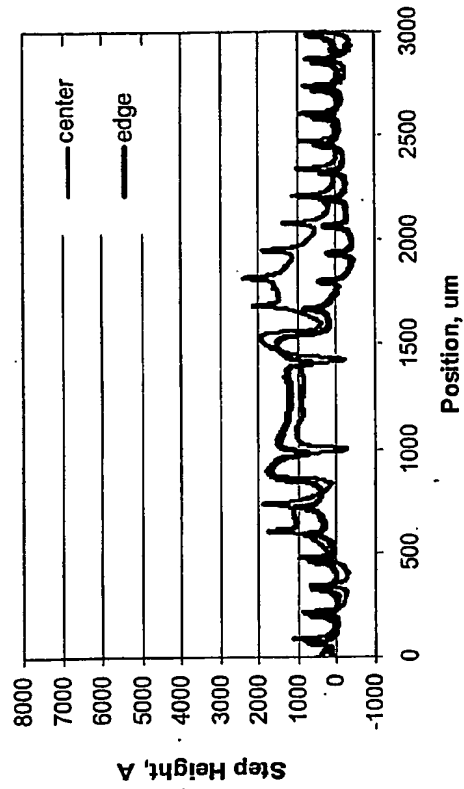
Dsp #	Dsp name	Solvent	Flow rate
1	SOD nozzle 1	Accuflo	0.45 ml/s
2	Solvent nozzle 2	PGMEA	0.60 ml/s
11	Inner cup rinse	PGMEA	300
12	Outer cup rinse	PGMEA	300
13	Edge bead rinse	PGMEA	30
15	Nozzle 1 rinse	PGMEA	30
16	Nozzle 2 rinse	PGMEA	30
21	Backside rinse	PGMEA	50

Table 9

Rcp position	Location, mm
home	-57.91
end	184.01
dummy	0
dispense 2	79.99
dispense 3	172.7
center	173.71
edge	79.99

Table 10

Figure 7



Event	Time	RPM	ACC	DSP	Arm 1
1	0.5	0	10000		disp 1, 150 mm/s, W
2	0.5	1000	10000	9	disp 1, 150 mm/s, NW
3	3.0	1500	10000		disp 1, 150 mm/s, NW
4	3.0	1500	10000		disp 5, 150 mm/s, NW
5	5.0	1500	10000		disp 5, 150 mm/s, NW
6	0.1	1000	10000	4	disp 5, 150 mm/s, NW
7	14.0	1000	10000		center, 20 mm/s, NW
8	2.0	800	10000		center, 150 mm/s, NW
9	3.0	100	10000		home, 150 mm/s, NW
10	4.0	300	10000		home, 150 mm/s, NW
11	5.0	600	10000		home, 150 mm/s, NW
12	6.0	900	10000		home, 150 mm/s, NW
13	6.0	1200	10000		home, 150 mm/s, NW
14	20.0	2000	9000		home, 150 mm/s, NW
15	1.0	1000	10000		home, 150 mm/s, NW
16	5.0	1500	9500		home, 150 mm/s, NW
17	5.0	1500	9500	13,21	home, 150 mm/s, NW
18	4.0	1500	9500	13,21	home, 150 mm/s, NW
19	10.0	2000	10000	13,21	home, 150 mm/s, NW

Table 11

Pump recipe	
time	14 s
volume	6 ml

Recipe position data (mm)			
begin	89	center2	170.5
end	180	edge	87
center1	170	dispense 5	88
		dispense 1	170.5

Table 12

Dsp #	Dsp name	Solvent	Flow rate
4	SOD nozzle 1	Accuflo rev2	use pump recipe
9	solvent	PGMEA	PGMEA pressure 0.1 Mpa
13	back side rinse	PGMEA	-
21	Edge bead rinse	PGMEA	-

Table 13

Accuflo2027 TMAH Resistance				
Sample#	Bake conditions	Th. Pre-TMAH A	Th. Post-TMAH A	Δ Thickness A
1.1	160/180C 90s air	20605	0	20605
1.2	160/180C 90s air	20576	0	20576
2.1	160/200C 90s air	19868	0	19868
2.2	160/200C 90s air	19953	0	19953
3.1	160/220C 90s air	18511	3550	14961
3.2	160/220C 90s air	18540	4081	14459
13.1	160/230C 90s air	17826	17828	-2
14.1	160/240C 90s air	17862	17856	6
15.1	160/250C 90s air	17190	17168	22
7.1	160/180C 120s air	20495	0	20495
7.2	160/180C 120s air	20516	0	20516
8.1	160/200C 120s air	19626	0	19626
8.2	160/200C 120s air	19702	0	19702
16.1	160/210C 120s air	19440	0	19440
9.1	160/220C 120s air	18289	18295	-6
9.2	160/220C 120s air	18254	18247	7
Wafers were dipped two min. in 2.3% TMAH at RT.				

Table 14

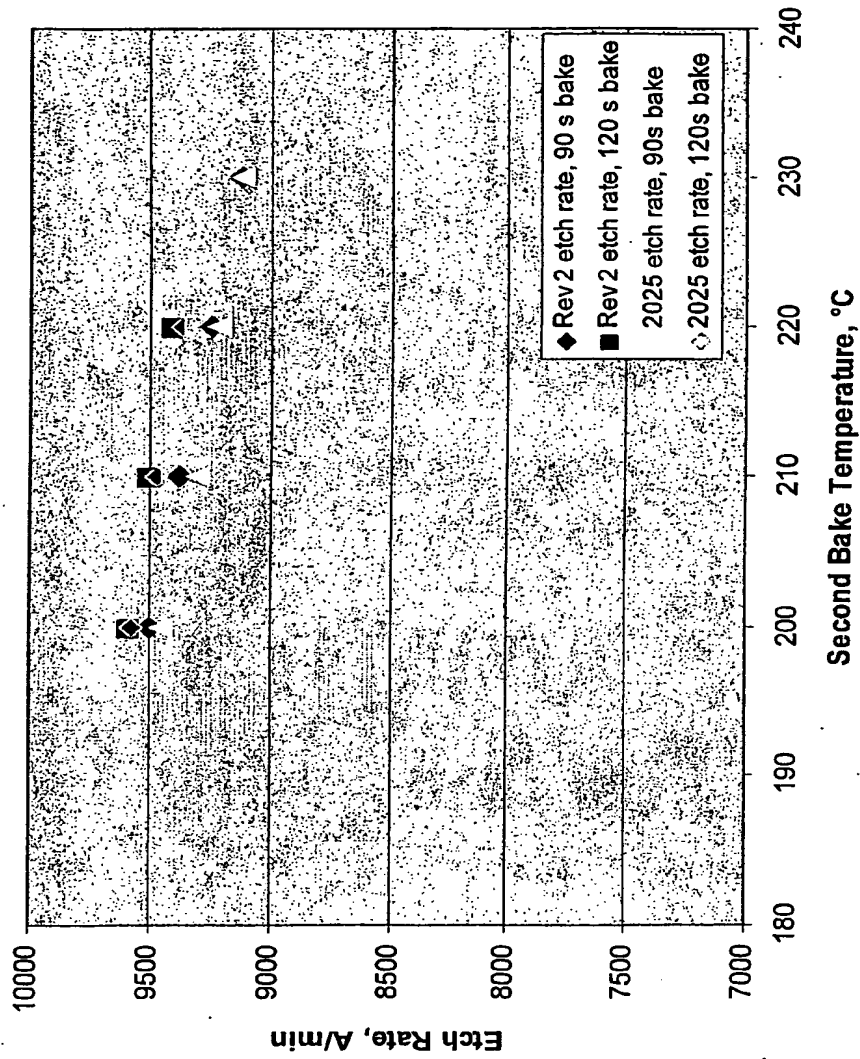


Figure 8

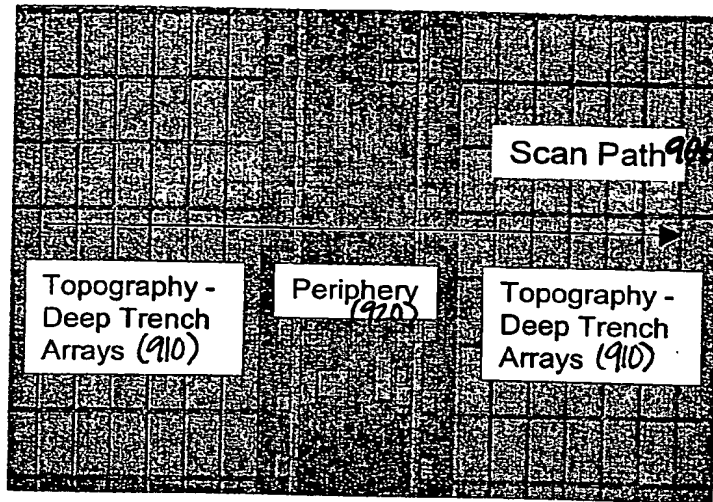


Figure 9

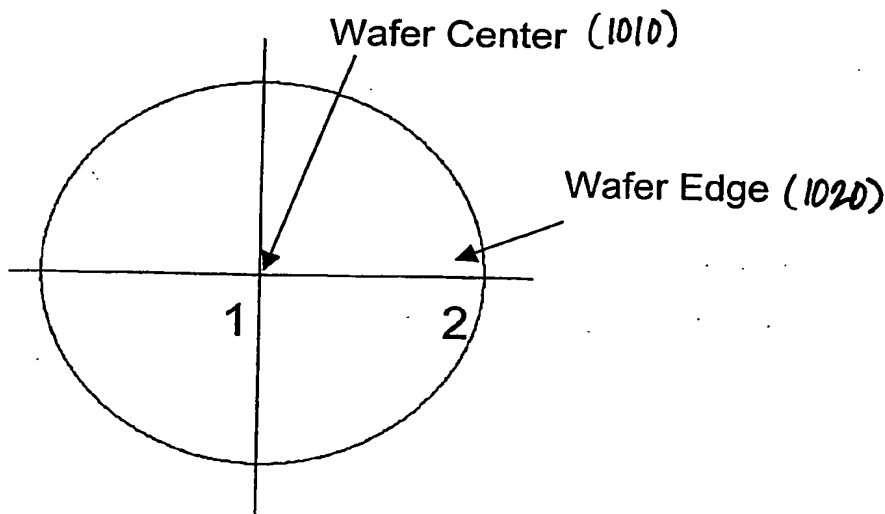
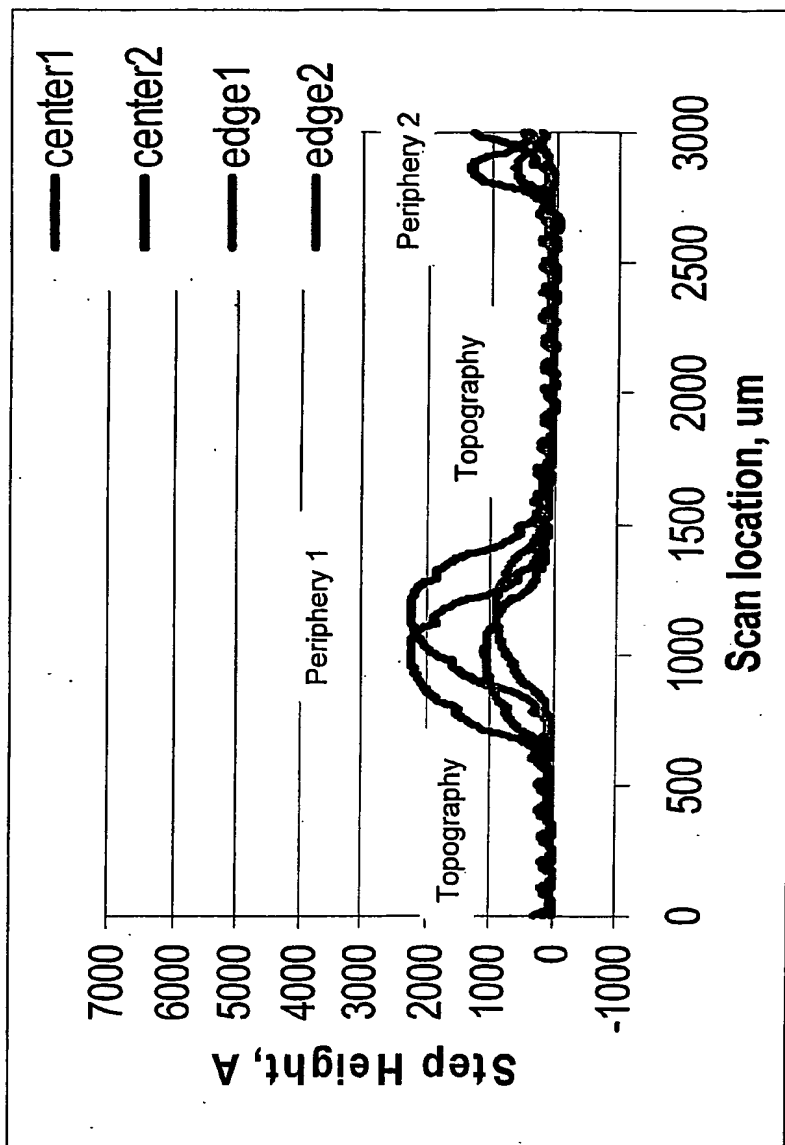


Figure 10

Accuflo2025 and Accuflo2027 Rev2 Planarization Comparison									
Material	Δ Thickness trench array-support (nm)				Δ Thickness trench array-support (nm)				
	standard process		BKM process		standard process		BKM process		
	center	edge	center	edge	center	edge	center	edge	
Accuflo2025	1200	850	650	250	1200	850	650	250	
1513EL	900	550	500	350					
Accuflo2027	500	400	380	220	750	260	260	150	

Table 15



$\Delta \text{Thickness}_{\text{max, topography-periphery}} = 230 \text{ nm}$

Figure 11

Film thx. at various locations	Wafer Center, nm	Wafer Midpoint, nm	Wafer Edge, nm
Thx. over trench array center	1910	1810	1810
Thx. over trench array edge	1810	1810	1950
Thx. over topography	1790	1860	1910
Thx. over periphery	1860	1910	1950
Chip-level thx. diff	120	100	140
Chip-level max thx. diff	140		
Wafer-level max thx. diff	160		

Δ Thickness max, topography-periphery = 160 nm

Table 6

Run	Bake			Ambient	Etchant	Exposure Time	Pre-etch		Post-etch	
	BP1	BP2	BP3				Thx, A	RI	Thx, A	RI
1	160°C (120 s)	180°C (120 s)		air	500:1 BOE	2 min	20783	1.61	20811	1.61
2	160°C (120 s)	180°C (120 s)		air	500:1 BOE	5 min	20783	1.61	20744	1.61
3	160°C (120 s)	200°C (120 s)		air	500:1 BOE	2 min	20835	1.63	20768	1.63
4	160°C (120 s)	200°C (120 s)		air	500:1 BOE	5 min	20835	1.63	20741	1.63
5	160°C (120 s)	180°C (120 s)	200°C (120 s)	air	500:1 BOE	2 min	19885	1.64	19827	1.64
6	160°C (120 s)	180°C (120 s)	200°C (120 s)	air	500:1 BOE	5 min	19885	1.64	19808	1.64
7	160°C (120 s)	200°C (120 s)	200°C (120 s)	air	500:1 BOE	2 min	19501	1.65	19415	1.65
8	160°C (120 s)	200°C (120 s)	200°C (120 s)	air	500:1 BOE	5 min	19561	1.65	19419	1.65
9	160°C (120 s)	200°C (120 s)	210°C (120 s)	air	500:1 BOE	2 min	19156	1.65	19126	1.65
10	160°C (120 s)	200°C (120 s)	210°C (120 s)	air	500:1 BOE	5 min	19156	1.65	19126	1.65

complete resistance to 500:1 BOE

Table 17

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